of bananas from the West Indies. A full description of the vessel appears in the *Engineer* for July 9, from which we note that she is of 5000 tons gross, having insulated space of 220,000 cubic feet, the capacity of the fruit bins being 175,000 cubic feet. Granulated cork is used for the insulating material, the average thickness of the cork being from 7 inches to 8 inches, and the bins are so constructed that the bunches of fruit do not come into contact with metal surfaces during transit, all such being protected by wood gratings and battens, or by hemp-rope coverings. An elaborate arrangement of air passages enables cooled air to be supplied throughout the cargo, the cooling of the air being effected by a Hall's CO_2 refrigerating plant. An even temperature of 55° F. is maintained, and the fruit is inspected frequently so as to ensure its arrival at Manchester in proper condition for the market. In loading, the fruit is stored without covering of any kind, the lowest bunches are arranged with stems vertical, and the final layer placed horizontally, an arrangement which economises space and ensures freedom from damage.

A SECOND edition of Mr. Arturo Massenz's "Lavorazione e Tempera degli Acciai" has been published by Mr. Ulrico Hoepli, of Milan. The price of the volume is 2 lire.

SOLUTIONS of the exercises in their "Modern Geometry" have been prepared by Messrs. C. Godfrey and A. W. Siddons, and are published in volume form by the Cambridge University Press at 4*s*. net.

MESSRS. DAWBARN AND WARD, LTD., have published a fifth edition of the 1909 "Photographic Annual, incorporating the Figures, Facts, and Formulæ of Photography." This year-book is edited by Mr. H. Snowden Ward, and the present issue has been extended, largely re-written, and revised to June, 1909.

MR. BERNARD QUARITCH has just issued a catalogue of books on natural history which he is offering for sale. Particulars are given of works on zoology, geology, palæontology, mineralogy, and botany. Among other interesting items we notice the original drawings of Hubner's European butterflies, an example of Jacquin's Selectarum Stirpium Americanarum Historia, and a few important herbals.

WE have received in two volumes parts A, B, C, and D of the quarterly bulletin of the results for the year 1907–8 secured during the periodical cruises and in intermediate periods in connection with the Permanent International Council for the Exploration of the Sea. The parts in order deal with the temperature and salinity of the surface water; the temperature, salinity, density, &c., of sea water at different depths; the oxygen, nitrogen, and carbon dioxide dissolved in sea water; and plankton tables for August and November, 1907, and February and May, 1908. The first three parts have been prepared with the assistance of Mr. Martin Knudsen, and the last with the help of Mr. Harry M. Kyle. The volumes are published by Andr. Fred. Høst et Fils, of Copenhagen.

OUR ASTRONOMICAL COLUMN.

STATIONARY METEOR RADIANTS.—Since Mr. Denning announced the existence of stationary meteoric radiants in 1878, many observers have endeavoured to explain, and account for, them, hitherto without much success. The apparent radiant of a meteor depends almost as much on the true direction of the earth's motion as it does on the true motion of the meteor itself, therefore it seems almost impossible that these bodies should appear to stream from the same point of the heavens for months at a time. In an article appearing in No. 5, vol. xxix., of the *Astrophysical Journal* (June, p. 365), Prof. W. H. Pickering shows, however, that this apparently puzzling phenomenon is only what is to be expected, arguing from our present knowledge of meteor-orbits. Briefly, he shows by diagrams and tables that the attracting force of the earth's mass is, at different times, capable of deflecting or accelerating the smaller bodies, so that the apparent change of the longitude of the radiant counterbalances the variation produced by the earth's motion; thus the radiant appears to be stationary, or nearly so. Prof. Pickering also produces arguments against the prevalent idea that meteors are generally of infinitesimal mass.

COMPARISON OF THE SPECTRA OF THE CENTRE AND EDGE OF THE SUN'S DISC.—Previous observations having indicated that in passing from the centre to the edge of the sun's disc the spectrum suffers modification, MM. Buisson and Fabry recently repeated the observation, using their interferometer method, in which each wave-length is examined independently of those of the other lines. Their observations, which are published in No. 26 of the *Comptes rendus*, confirm the earlier ones of Hale and Adams, and Halm.

The latter showed that the wave-length of a line in the spectrum at the limb was a little greater than when the centre of the disc was observed. From the study of fourteen lines in the region of λ 4400 MM. Buisson and Fabry find that the increase of wave-length varies from 0·004 to 0·006 Ångström; to this rule the two vanadium lines, λ 4379·4 and λ 4406·8, are exceptions. The observations also show that in the spectrum at the limb the same lines are a little broader than in the spectrum at the centre, the increase of breadth amounting, in the mean, to 0·010 Ångström.

MM. Buisson and Fabry suggest that these two phenomena, displacement and broadening, are due to the same cause. The only modification a line really undergoes is a displacement, amounting to 0·010 Ångström, of its red edge, the more refrangible edge remaining invariable. In the exceptional case of vanadium the broadening is apparently symmetrical. They suggest, further, that the asymmetrical broadening may be caused by pressure—an increase of seven atmospheres would be sufficient to produce the observed effect—but only becomes apparent at the limb where a greater thickness of the denser layers is traversed by the radiations.

CHANGES OF FORM IN SUN-SPOTS.—Some interesting results of detailed observations of sun-spot forms are discussed, and illustrated by drawings, by M. A. Amaftounsky in No. 4332 of the *Astronomische Nachrichten*.

He shows that whilst, in general, the outline of the penumbra roughly follows the form of the nucleus, tremendous changes may take place in the former, whilst the latter is apparently undisturbed. This is what would be expected on the hypothesis that the nucleus of the spot is a depression, a hole, and the penumbra is produced by the ascending and descending of incandescent vapours. The appearance of bright spots in the nucleus, sometimes followed by the bridging and disintegration of the latter, is explained by the supposition that the nucleus is at a higher temperature than the photosphere, and constantly re-vaporises the filaments and tongues of the penumbra by the expulsion of hotter vapours.

MUTUAL OCCULTATION OF JUPITER'S SECOND AND FOURTH SATELLITES.—In No. 4338 of the *Astronomische Nachrichten* M. Pidoux describes the conjunction and mutual occultation of J ii. and J iv. observed by him at the Geneva Observatory on June 17, 1908. Plotting the various measures, he finds that the conjunction took place at 8h. 33·4m. (G.M.T.), the shortest distance between the centres of the satellites being 1·9″. Whilst the latter quantity agrees exactly with that calculated and published by Oudemans, the time is 4·6 minutes in advance of the ephemeris.

According to calculation, satellites iii. and iv. should have been in conjunction at 7h. 58·5m. on July 3, 1908, but when first observed by M. Pidoux, at 7h. 52m., the conjunction was already complete and the satellites appeared as one. At 7h. 59m. the system was elongated, and at 8h. 2m. the two images were distinctly separated. It therefore appears that the observations prove the calculated times to be several minutes too late.

© 1909 Nature Publishing Group

The Yerkes Observatory.—From the University of Chicago we have received a brochure in which Prof. E. B. Frost gives a brief, detailed account of the establishment, equipment, and work of the Yerkes Observatory. Fourteen excellent reproductions of photographs of instruments, spectroheliograms, nebulæ, &c., illustrate the twenty-four pages of the booklet, and give the reader a very fair idea of the enormous activities and possibilities of the institution. One point which attracts our attention is Prof. Frost's emphasis of the necessity for having, in a modern astronomical observatory, well-equipped workshops wherein repairs and modifications of existing instruments may be executed, and new instruments constructed.

Prominence Observations.—No. 6, vol. xxxviii., of the *Memorie della Società degli Spettroscopisti Italiani* contains Prof. Ricco's periodical summary of the Catania prominence observations, dealing with the first six months of 1908. Prominences were observed on ninety-three days during the six months, and 170 in the northern, and 247 in the southern, hemisphere were measured. The mean latitude for the two hemispheres was 27·5°, but, dividing the latitude, N. and S., into 10° steps, there were two maxima (lat. 10°–20° and 50°–60°) in the northern hemisphere and only one (20°–30°) in the southern.

SCIENTIFIC WORK IN INDIA.

The annual report of the Board of Scientific Advice for India for the year 1907–8 has lately been issued by the Superintendent of Government Printing, Calcutta. The Board was constituted in 1902, and consisted originally of the heads of the meteorological, geological, botanical, forest, survey, agricultural, and veterinary departments, but the Government of India invites from time to time to serve upon it other men of science in the service of the imperial and provincial Governments. The Board is a central authority for the coordination of official scientific inquiry, intended to ensure that the work of research is distributed to the best advantage and the prevention of useless duplication of inquiries and lack of interdepartmental cooperation. The advice of the Board is given with the view of aiding the Government of India in prosecuting practical research into questions of economic and applied science on the solution of which the progressive prosperity of the country depends. The Board discusses annually the proposals of the head of each of the great departments in regard to the programme of investigation in his department, and submits each year a general programme of research to the Government. Its reports and programmes are communicated through the Secretary of State for India to the Royal Society, which has appointed an advisory committee to consider them.

The present report opens with a summary of the proceedings at the three meetings held during 1908, two at Calcutta and one at Simla. As indicative of the scope of the labours of the Board, some of the subjects discussed at the first meeting may be mentioned. The Board had under consideration the remarks of the Royal Society committee on the Board's report for 1905–6 and its programme for 1907–8. The subjects discussed included, among many others, the preparation of a hand-list of the species of the flora of India, economic and industrial chemistry, and the limits of the imperial mycologist's research work, the relations of the zoological section of the Indian Museum to other departments engaged in zoological research, and proposals for a special report on the progress of the Geological Survey.

The conclusions arrived at by the Board in these matters were as follows:—that, as regards the preparation of a hand-list of the flora of India, although its importance was recognised, lack of staff and the existence of more immediately necessary work precluded its preparation forthwith; that the consideration of economic and industrial chemistry and the work of the imperial mycologist should await the results of the discussion of the subjects by the Board of Agriculture for India; that reference should be made, so far as possible, to the zoological section of the Indian Museum by other departments engaged in zoological research; and that no officer was available for the increase of work that the preparation of a special report on the progress of the Geological Survey of India would necessitate.

Very full reports upon the work of the various scientific departments during the year 1907–8 then follow. Dr. J. W. Leather and Mr. D. Hooper deal with the work on industrial and agricultural chemistry, and Mr. Puran Singh with forest chemistry; Dr. G. T. Walker, F.R.S., with solar physics, meteorology, and terrestrial magnetism; Sir Thomas H. Holland, F.R.S., with geology; Colonel S. G. Burrard, F.R.S., with geodosy and geography; Messrs. W. W. Smith, A. Howard, E. J. Butler, and R. S. Hole with various branches of botany; Mr. A. M. F. Caccia and A. J. Gibson with forestry; Dr. N. Annandale and Messrs. H. Maxwell-Lefroy and E. P. Stebbing with zoological subjects; and Colonel H. T. Pease with veterinary science.

The programmes of work of the various scientific departments for the year 1908–9, as approved by the Board, constitute the next section of the volume, which concludes with an appendix by Dr. W. R. Dunstan, F.R.S., director of the Imperial Institute, describing the economic investigations conducted for India at the Imperial Institute during the year ended September 30, 1908.

The detailed programmes of work teem with particulars of investigations of great interest, but since the bare enumeration of the researches to be undertaken runs to twenty-seven large pages, it is possible here only to give an example or two. In meteorological work, a special endeavour is being made this year to secure meteorograph records of temperature and humidity up to great heights by means of small balloons. At four nearly equidistant periods between April and December batches of registering balloons have been, and are to be, liberated at some place in the west of the Punjab, and organised efforts made to recover as many as possible on descent. Each batch was to comprise, perhaps, ten complete units, the adjustment and liberation of which takes between a week and ten days. It was hoped to reach heights of 25,000 feet in the earlier experiments, and later in the year it is hoped to increase the heights at which the balloons are caused to descend until 50,000 feet has been reached. It is important to reach this height in order to see whether the isothermal zone, which has been almost invariably found at or near that level by sounding balloons in Europe, is to be encountered over India.

The new work to be undertaken by the Geological Survey provides another typical instance of the activity of scientific workers in India. The mapping of previously unsurveyed areas in the Amherst district of Lower Burma is being proceeded with, the geological map of the Raniganj coalfield is being revised in conjunction with a committee appointed by the Mining and Geological Institute of India, and the following pieces of work are in hand:—a survey of the ossiferous deposits of the Siwaliks and the Salt Range; an examination of copper-ore and associated sulphide-ore deposits in Sikkim; a survey of certain glaciers in Sikkim; and a study of the palæontology of (*a*) the Cretaceous rocks of Tibet, (*b*) the fossil fishes of the East Coast Gondwanas.

POSITION FINDING WITHOUT AN HORIZON.

When about three years ago the first Gordon-Bennett balloon race was held, and several of the aëronauts descended precipitately on the north coast of France, believing they were approaching the Bay of Biscay, it seemed to me worth while to consider the possibility of designing an instrument by the aid of which observations could be taken so as to obtain even a rough idea of position. For this purpose the observation of the altitude and azimuth at any moment of a single star or of the sun will be sufficient to establish the locality, or the altitudes of two stars not in the same vertical plane with the observer will do as well.

If the observation is such that the error is as great as the diameter of the sun or moon, the resulting uncertainty of position will be a little more than thirty miles, and so in proportion. The observer will be, of course, on a circle on the earth described round the point where the star is in the zenith, the radius of which in nautical miles is

© 1909 Nature Publishing Group